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Species of *Hemitrichia (Trichiaceae, Myxomycetes)* in Brazil

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Abstract — In Brazil, eight *Hemitrichia* species are known. Their geographical distribution is herein established and mapped for the four main Brazilian biomes: Amazonian Forest, Cerrado, Caatinga, and Atlantic Forest. *Hemitrichia insignis* is reinstated, and *H. spinifera* is now reported for the first time outside of Colombia.

Key words — Neotropical myxobiota, taxonomy, Cerrado myxomycetes

Introduction

Martin (1948) favored the name *Hyporhamma* Corda over *Hemitrichia* Rostaf., which had been published almost two decades later. However, Martin & Alexopoulos (1969), Farr (1976), Martin et al. (1983), and Lado & Pando (1997) adopted *Hemitrichia*, considering *Hyporhamma* as a nomen confusum. Finally, Lado (2001) recombined the species of *Hemitrichia* into *Hyporhamma*. Although admitting that *Hyporhamma* was nomenclaturally the correct name, Lado et al. (2005) suggested conservation of *Hemitrichia,* based on Article 14.1 of the International Code of Botanical Nomenclature. The proposition was approved and is shown in the last version of the Vienna Code (McNeill et al. 2006: 203).

Hemitrichia presently accommodates 26 species, 13 of them known from the Neotropical Region (Lado 2001, Hernández-Crespo & Lado 2005, Bezerra 2008). Most species were described in the last 50 years, including *H. spinifera*, until now known only from a collection from North Santander, Colombia (Farr 1979). Torrend (1916) described *H. insignis* Torrend and deposited the

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holotype in Herbarium URM. However, the publication only became known recently (Góes Neto & Cavalcanti 2002), so the new species was not accepted by Lado (2001), who did not examine the type material.

Lister (1925) indicated that the type material of *Arcyria decipiens* Berk. collected in 1832 by Charles Darwin in Rio de Janeiro was indeed a typical specimen of *H. clavata,* making this the first record of a *Hemitrichia* species in Brazil.

The first overview of the Brazilian myxomycetes by Torrend (1915) listed 80 species representing 23 genera. Among the *Hemitrichia* species just two (*H. clavata* and *H. serpula*) were mentioned, with *H. serpula* present in the states of Rio de Janeiro, São Paulo, and Bahia. Cavalcanti (1974, 1976, 2002) expanded our knowledge of species of *Hemitrichia* in Brazil, reporting *H. minor* (as *Perichaena minor*), *H. pardina* (as *P. minor* var. *pardina*), and *H. leiocarpa* (as *Arcyria leiocarpa*) from the State of Pernambuco. In this paper, the species of *Hemitrichia* detected in Brazil will be the object of specific commentaries, with special attention to *H. insignis* and *H. spinifera*, the latter recently collected from the Cerrado in Brasília, Distrito Federal.

Material and methods

Hemitrichia specimens from different Brazilian biomes were examined, including new collections from Central and Northeast Brazil. Identifications were determined following Martin & Alexopoulos (1969), Farr (1976, 1979), Martin et al. (1983), and Lado & Pando (1997).

Selected specimens were illustrated, with emphasis placed on the morphology of spores, sporangia, and other taxonomically meaningful structures. Also included are distribution maps of the Brazilian species of *Hemitrichia*. Materials from seven Brazilian herbaria [HUEFS – Herbarium of the Universidade Estadual de Feira de Santana, Feira de Santana, Bahia), IPA – Herbarium Dardano de Andrade Lima, Empresa Pernambucana de Pesquisa Agropecuária, Recife, Pernambuco, JPB – Herbarium of the Universidade Federal da Paraíba, João Pessoa, Paraíba, UFBA – Herbarium of the Universidade Federal da Bahia, Salvador, Bahia, UFP – Herbarium of the Universidade Federal de Pernambuco, Recife, Pernambuco; URM – Herbarium of the Departamento de Micologia, Universidade Federal de Pernambuco, Recife, Pernambuco, and UB [Mycological Collection] – Herbarium of the Universidade de Brasília, Brasília, Distrito Federal] were studied.

Hemitrichia insignis, a taxon proposed by Torrend (1916) is here reinstated; *H. spinifera* is reported for the first time from somewhere other than the type location; and finally comments on the distribution and records of six more species of *Hemitrichia* in Brazil are shown.

Taxonomy and geographical distribution

The goal of this study is to add to our knowledge of the Brazilian myxobiota, and also to highlight the first records of the *Trichiaceae* in Central-Western Brazil.

Over 300 exsiccates of *Hemitrichia* species collected in Brasília were examined, but only the best material is cited. Other materials were collected in eleven different states distributed from the Equatorial Amazonas to south of the Tropic of Capricorn in the State of Santa Catarina.

Among species of *Hemitrichia,* Farr (1976) listed for Brazil only *H. calyculata*, *H. clavata*, and *H. serpula*. However, in 1916 *H. insignis* was described from the State of Bahia and Cavalcanti (1974) reported *Perichaena minor*, and *P. minor* var. *pardina* from the state of Pernambuco, species later included in *Hemitrichia* by Hernández-Crespo & Lado (2005) as *H. minor* and *H. pardina,* respectively. Later, Cavalcanti (1976) also reported *H. leiocarpa* in the same state. Finally, now *H. spinifera* is reported here from Brasília, Distrito Federal, thus completing eight species for the entire country.

Additionally reinstatement of *H. insignis* is proposed based on the study of the type material collected in Bahia (Figure 1) and the original description by Torrend (1916). Also, a detailed description of the Brazilian specimen of *H. spinifera* is given**.**

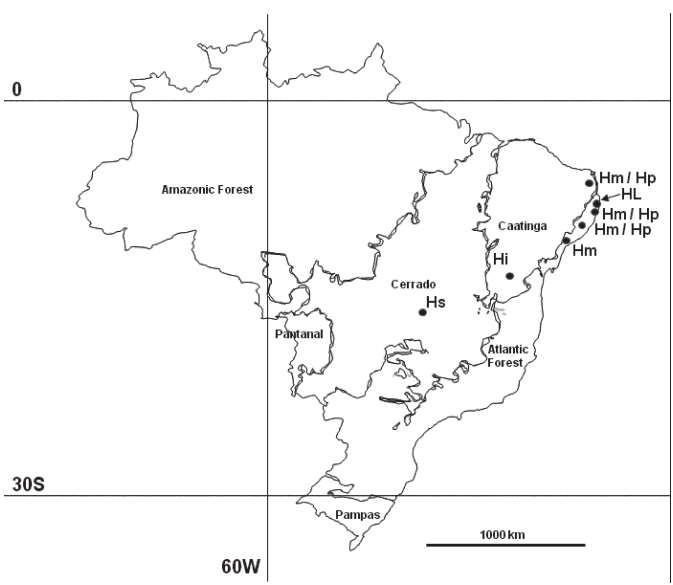

Fig. 1. Distribution of *Hemitrichia insignis* (Hi), *H. leiocarpa* (Hl), *H. minor* (Hm), *H. pardina* (Hp), and *H. spinifera* (Hs) in two Brazilian biomes: Caatinga (semi-arid region) and Cerrado.

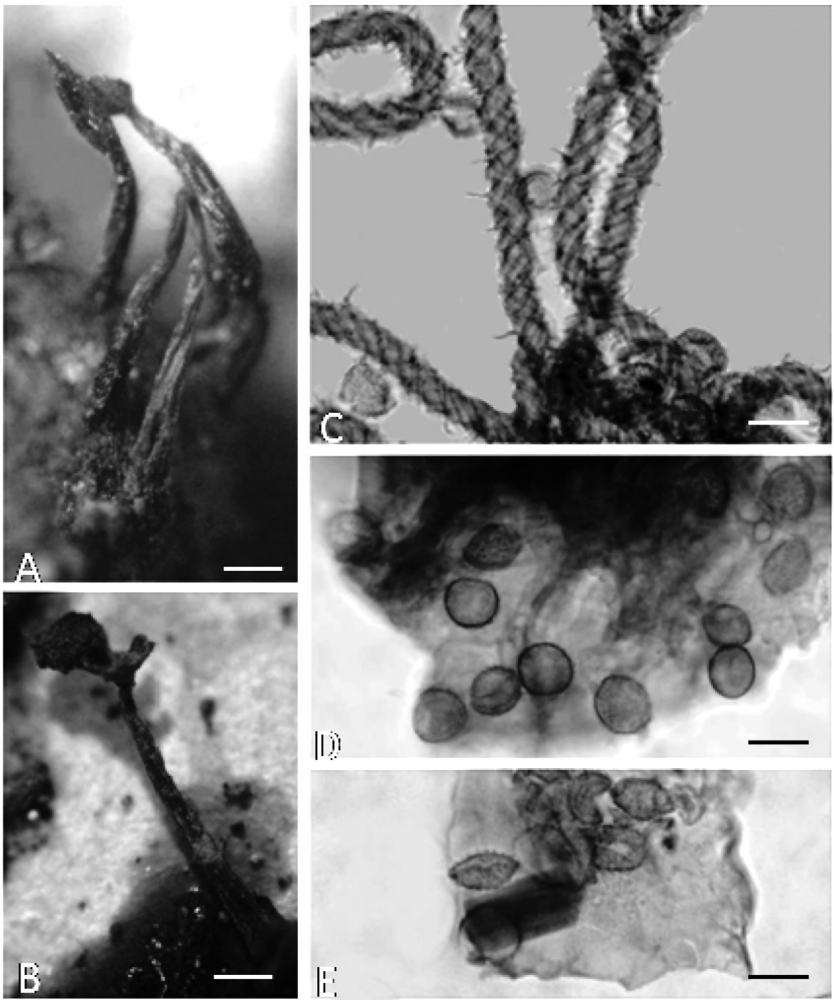

Fig. 2. A–E. *Hemitrichia insignis*. A – Pedicels of the fruiting bodies (bar = 250 µm). B – Sporangium with remnants of the peridium forming a calyculus µm (bar = 250 µm). C – Coiled capillitium with a spinulose surface (bar = 10 µm). D – Spores (bar = 10 µm). E – Surface of the peridium (bar = 10 µm).

Hemitrichia insignis Torrend, Congr. Nac. Geogr. Brasil, Salvador: 489 (1916). Fig. 2
MycoBank, MB 512258

The type specimen was described by Torrend (1916) as having *"Plasmodium? Totus fungus-2-3 mm. longus, aurantiaco-ferrugineus; sporangia globosa, longistipitata, 1 mm crassa; peridium leve, nitidum, ad modum caliculi in parte inferiori persistens; stipes 1-2 mm longus, concolor, lucidus, sulcatus; capillitium simplex vel parum ramosum quase*

constaret unico filamento longissimo e dense involuto, 4-5 μm diam. crassum (6-8 μm. cum aculeis); duobus taeniolis spiralibus aculeatis pulchre ornatum; aculei 1-3 μm. longi; sporae aurantiacae, verrucosae, ad marginem incrassatae, 8-10 μm. diam. Hab. Ad fragmenta lígnea, in nemore denso prope. Poções. Januario."

Specimens examined: **BRAZIL**. **Bahia**: Poções, 1916, *leg Camille Torrend*, URM 574A-10011 (holotype).

Plasmodium not seen. Thalli 2–3 mm long, rusty-orange. Sporangia globose, long-stalked, 1 mm wide. Peridium smooth, shiny, shown as calyculus at the lower portion. Stipes 1–2 mm long, concolorous, shiny, sulcate. Capillitium simple or seldom branched, mostly consisting of one densely involute and long filament, 4–5 μm diam., 6–8 μm when including the spines; forming two spiral spiny ropes beautifully ornamented; spines 1–3 μm long. Spores orange, verrucose, thick walled, 8–10 μm diam.

Comment: Torrend (1916) considered the type specimen of *H. insignis* macroscopically similar to *H. vesparium* [=*Metatrichia vesparium*]; however, he emphasized that the microscopic characters were different, e.g.: his new species showed a fragile peridium with irregular dehiscence contrasting with the leathery peridium and circumcised dehiscence present in *M. vesparium*. The type material in Herbarium URM [URM 574A-10011] still contains sporangia with some damage but enough to confirm the essential characteristics described by Torrend (1916), thus justifying this proposition for the reinstatement of *H. insignis*.

Hemitrichia spinifera M.L. Farr, Nova Hedwigia 31(1–3): 110 (1979). Figs. 1, 3

≡ *Hyporhamma spiniferum* (M.L. Farr) Lado [as '*spinifera*'], Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) 16: 48 (2001).

Specimens examined: **BRASIL**. **Distrito Federal**: Brasília, Jardim Botânico, Córrego Cabeça de Veado, 27 Aug 2001, *leg M. Sanchez 4031* (UB Mycol Col. 18558); idem, 27 Aug 2001, *leg A.C.C. Bezerra 432* (UB Mycol Col. 18560); idem, 27 Aug 2001, *leg A. C. C. Bezerra* 433 (UB Mycol Col. 18561); idem, 27 Aug 2001, *leg A. C. C. Bezerra* 434 (UB Mycol Col. 18562). **COLOMBIA**. **Santander:** North of Santander, about 3,300 m alt., 21 Aug 1976, *leg K. P., Dumont, MA. Sherwood, and L. F. Velasquez, BPI 838725,* U.S. National Fungus Collections, USDA. BPI 838725.

The four specimens collected in Brasília, Distrito Federal (Figure 1), were all identified as *H. spinifera* when compared with the type material collected at the type location in Colombia, establishing this as a second record of the species worldwide after the original description by Farr (1979).

Hemitrichia leiocarpa (Cooke) Lister, Monogr. Mycetozoa: 177 (1894).

≡ *Hemiarcyria leiocarpa* Cooke, Annals Lyceum nat. Hist. N.Y. **11**(12): 405 (1877).

≡ *Arcyria leiocarpa* (Cooke) Massee, Monogr. Myxogastr. (London): 167 (1892).

≡ *Hyporhamma leiocarpum* (Cooke) Lado [as '*leiocarpa*'], Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) **16**: 47 (2001).

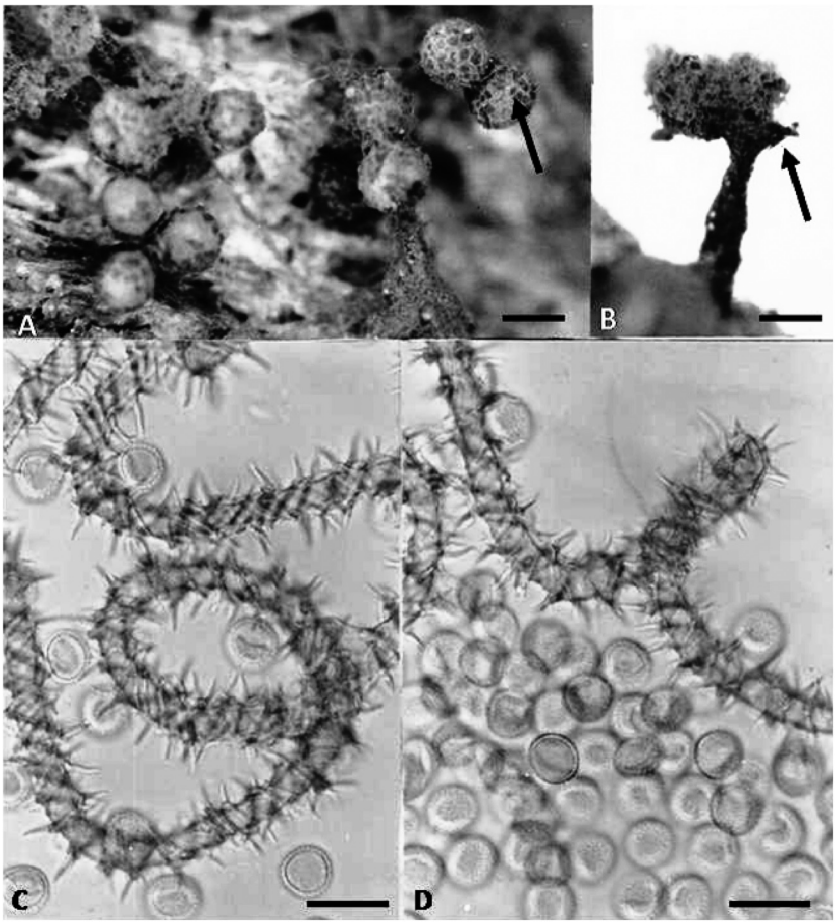

Fig. 3. A–D. *Hemitricha spinifera*. A and B – Sporangia (bar = 0.5 mm); C – Spinulose filaments of the capillitium (bar = 10 μm); D – Spores and capillitium (bar = 10 μm).

Hemitrichia leiocarpa is known in Brazil only from Pernambuco (Fig. 1) through a collection (BPI 833075) from a decaying trunk of *Cocos nucifera* L. (Cavalcanti 1974).

Hemitrichia minor G. Lister, J. Bot. 49: 62 (1911).

≡ *Perichaena minor* (G. Lister) Hagelst., Mycologia 35(1): 130 (1943).

≡ *Hyporhamma minus* (G. Lister) Lado [as '*minor*'], Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) 16: 48 (2001).

The first specimen of *H. minor* from Brazil was collected in the state of Pernambuco (Cavalcanti 1974), then identified as *Perichaena minor*. Later,

also in Pernambuco, Cavalcanti & Dias-Filha (1985), studying the *Trichiales* on bryophytes at the Herbarium UPE, found *H. minor* on trunks of living trees belonging to the *Fabaceae*, *Moraceae*, and *Anacardiaceae*. An additional sample was detected on the decaying spathe of an unidentified member of the *Arecaceae*. Recently, a specimen was found on herbivorous manure in a savanna region of the state of Sergipe in the Brazilian Northeast (Bezerra et al. 2008). Now, *H. minor* is reported for the first time from a natural reserve of the Atlantic Forest in the state of Rio Grande do Norte, on leaves of *Cecropia adenopus* Mart. ex Miq. (*Cecropiaceae*), and its distribution is shown in Figure 1. *Hemitrichia minor* was also found on a cactaceous substrate (*Copiapoa* sp.) in Chile by Lado et al. (2007), who together with Farr (1976) noted that the species is common in arid regions of North America, but rare in South America. However, the specimens known in Brazil are mostly from cultures yielding few sporangia in wet chambers using substrates collected in humid habitats (Fig. 1).

Hemitrichia pardina (Minakata) Ing, Myxomycetes Britain and Ireland: 132 (1999).
- ≡ *Hemitrichia minor* var. *pardina* Minakata, in Lister, Trans. Br. mycol. Soc. 5: 82 (1915).
- ≡ *Perichaena minor* var. *pardina* (Minakata) Hagelst., Mycologia 35(1): 131 (1943).
- ≡ *Hyporhamma pardinum* (Minakata) Lado [as '*pardina*'], Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) 16: 48 (2001).

Hemitrichia pardina is seldom found but has been known for more than three decades in Pernambuco, Northeast Brazil, when it was treated as *Perichaena minor* var. *pardina* (Cavalcanti 1974). Recently, specimens were collected in the neighboring states of Alagoas and Rio Grande do Norte (Cavalcanti et al. 2005) (Figure 1).

Hemitrichia clavata (Pers.) Rostaf, in Fuckel,
Jahrb. Nassauischen Vereins Naturk. 27–28: 75 (1873).
- ≡ *Trichia clavata* Pers., Neues Mag. Bot. 1: 90 (1794).
- ≡ *Hemiarcyria clavata* (Pers.) Rostaf., Śluzowce monogr. (Paryz): 264 (1875).
- ≡ *Arcyria clavata* (Pers.) Massee, Monogr. Myxogastr. (London): 165 (1892).
- ≡ *Hyporhamma clavatum* (Pers.) Lado [as '*clavata*'], Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) 16: 47 (2001).

Hemitrichia clavata and *H. calyculata* are morphologically similar, but Lado & Pando (1997) separated the two taxa as follows: *H. clavata* would show darker sporangial pedicels and larger spores than *H. calyculata*. Martin & Alexopoulos (1969) and Farr (1976) suggested that the materials from the Tropics should be re-examined because apparently many tropical collections of *H. clavata* have proven to be *H. calyculata*. Hence, two specimens from Recife, state of Pernambuco, previously identified as *H. clavata* (Mariz & Cavalcanti 1970) were re-examined and shown to belong in *H. calyculata*. However, in Brazil *H. clavata* is not common although it is known in warmer areas such as the

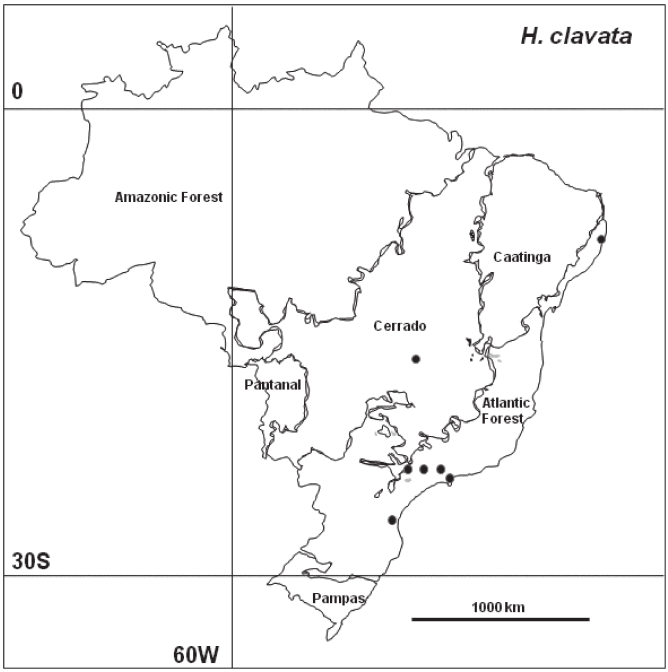

Fig. 4. Distribution of *Hemitrichia clavata*. in three of the main Brazilian Biomes: Atlantic Forest, Caatinga and Cerrado.

Brazilian Northeast (Cavalcanti 2002) and the southeastern state of São Paulo (Hochgesand & Gottsberger 1996, Maimoni-Rodella 2002). It is also known from the cooler areas of South Brazil. Bresadola (1896) first recorded the species in Brazil based on Alfredo Möller´s collections in Blumenau, State of Santa Catarina, as *Hemiarcyria clavata* (=*Hemitrichia clavata*). For the first time *H. clavata* is reported here from Central Brazil through a collection in gallery forest located at Brasilia, Distrito Federal, as seen in Figure 4.

Hemitrichia calyculata (Speg.) M.L. Farr, Mycologia 66: 887 (1974).

≡ *Hemiarcyria calyculata* Speg., Anal. Soc. cient. argent. 10: 152 (1880).

≡ *Hemitrichia clavata* var. *calyculata* (Speg.) Y. Yamam., in Yamamoto et al., Crypt. Flora .Pakistan (Tokyo) 2: 28 (1993).

≡ *Hyporhamma calyculatum* (Speg.) Lado [as '*calyculata*'], Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) 16: 47 (2001).

= *Hemiarcyria stipitata* Massee, J. Roy. Microscop. Soc. 1889(1): 354 (1889).

≡ *Arcyria stipitata* (Massee) Massee, Monogr. Myxogastr. (London): 163 (1892).

≡ *Hemitrichia clavata* var. *stipitata* (Massee) Torrend, Brotéria 7: 50 (1908).

≡ *Hemitrichia stipitata* (Massee) T. Macbr., N. Amer. Slime-Moulds (New York): 207 (1899).

The comprehensive material studied shows that *H. calyculata* occurs in Brazil in different types of habitats varying from equatorial regions in densely shadowed Atlantic or Amazonian forest, in the Cerrado, or in the semi-arid Northeastern Caatinga, in addition to being found on debris or the bark of trees in areas with degraded vegetation, in urban sites, and in sugar cane plantations (Cavalcanti 1996, Cavalcanti et al. 2005), distributed as in Figure 4. A collection of *Hemitrichia clavata* var. *calyculata* by Sannomiya in 1939 from São Paulo, exsiccate TNS-M-R: 1514, was given by Goro Hashimoto to Emperor Showa, and remains deposited in the Herbarium of the National Science Museum in Tokyo (Yamamoto et al. 2000).

The first record of *H. calyculata*, [identified as *H. stipitata* in the Brazilian Northeast was from the state of Pernambuco, later detected also in the state of Alagoas (Cavalcanti et al. 1985) growing on sugarcane debris, and in fragments of the Atlantic Forest (Cavalcanti et al., 2006). The same species was found on palm trees, and second growth forests in the states of Ceará and Piauí (Alves & Cavalcanti 1996; Cavalcanti & Putzke 1998; Mobin & Cavalcanti 2000, Mobin & Cavalcanti 2001, Cavalcanti 2002). Other records include coastal areas, and parts of the Biome Caatinga in Bahia; sugarcane plantations in the states of

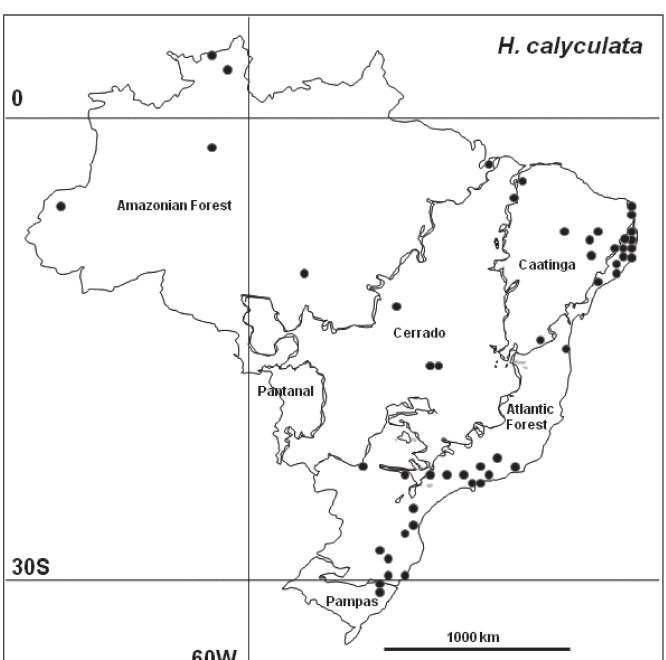

Fig. 5. Distribution of *Hemitrichia calyculata* in the four main Brazilian Biomes: Amazonian Forest, Atlantic Forest, Caatinga and Cerrado.

Pernambuco and Paraíba, and in urban areas of Rio Grande do Norte, Paraíba and Pernambuco (Farr 1960, Gottsberger 1968, Cavalcanti & Marinho 1985, Santos & Cavalcanti 1988, Alves & Cavalcanti 1996, Cavalcanti 1996, 2002, Bezerra et al. 2007). In North Brazil, *H. calyculata* was found in the states of Amazonas and Roraima (Farr 1985, Cavalcanti et al. 1999). Finally, the species is known from South Brazil in the states of Paraná, Santa Catarina and Rio Grande do Sul (Guerrero 1985, Gottsberger et al. 1992, Cavalcanti & Fortes 1994). Now for the first time *H. calyculata* is reported here from Brasília in Central Brazil, based on collections of 2000 and 2002. The distribution of *H. calyculata* is shown in Figure 5.

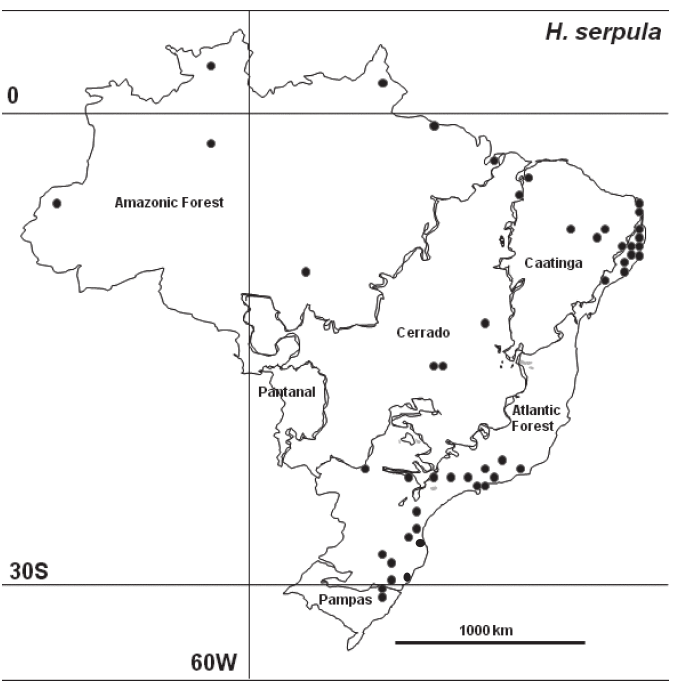

Fig. 6. Distribution of *Hemitrichia serpula* in the four main Brazilian biomes: Amazonian Forest, Atlantic Forest, Caatinga and Cerrado.

Hemitrichia serpula (Scop.) Rostaf. ex Lister, Monogr. Mycetozoa: 179 (1894).

Mucor serpula Scop., Fl. carniol., Edn 2 (Wien) 2: 493 (1772).
Trichia serpula (Scop.) Pers., Tent. disp. meth. Fung.: 10 (1797).
Hemiarcyria serpula (Scop.) Rostaf., Śluzowce monogr. (Paryz): 266 (1875).
Arcyria serpula (Scop.) Massee, Monogr. Myxogastr. (London): 164 (1892).
Hyporhamma serpula (Scop.) Lado, Cuadernos de Trabajo de Flora Micológica Ibérica (Madrid) 16: 48 (2001).

Hemitrichia serpula is the most common species in the genus occurring in Brazil (Cavalcanti 2002, Maimoni-Rodella 2002, Putzke 2002). The first record of the species in South Brazil (Jahn 1902) was based on collections from Blumenau, state of Santa Catarina. *Hemitrichia serpula* was found again in Santa Catarina, Paraná, and in Rio Grande do Sul (Rodrigues & Guerrero 1990, Gottsberger et al. 1992, Cavalcanti & Fortes 1994). Jahn (1904) detected *H. serpula* from the state of Amazonas, where the species is presently known in the states of Amapá, Amazonas, Pará, and Roraima (Cavalcanti 2002; Cavalcanti et al. 1999). In the Southeastern region of Brazil the first record came from the state of São Paulo (Höhnel 1907). New records for the region came from collections in the states of São Paulo and Rio de Janeiro (Torrend 1915, Maimoni-Rodella & Gottsberger 1980, Rodrigues 1985). In the Brazilian Northeast *H. serpula* has been known since the early twentieth century (Torrend 1915) at different localities in the state of Bahia; and later in the states of Alagoas, Ceará, Paraiba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe (Batista 1949; Farr 1960; Mariz 1968; Cavalcanti 1976; Cavalcanti & Marinho 1985; Alves & Cavalcanti 1996; Mobin 1997; Cavalcanti 2002; Bezerra et al. 2007, Bezerra et al. 2008). In Central Brazil *H. serpula* is now reported in Mato Grosso based on collection by J.R. Weir, in 1923 (BPI 839124), and also from Cerrado and gallery forest in Brasília, Distrito Federal. The distribution of the species in Brazil is shown in Figure 6.

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